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Science News x

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CORAL REEFS AS ZONATIONAL PLANT FORMATIONS[1]

IN choosing a meeting of the Botanical Society of America for the presentation of a paper concerning itself with coral reefs, I am acting deliberately and with serious intention of emphasizing a point, to me at least, seemingly fundamental to all coral reef discussion, and that is this: the coral reef, so called, is dominated and controlled by its plant symbionts even where there is a variety of organisms concerned. Furthermore, there are certain reefs, and these even of the complex atoll type, which are so overwhelmingly, even completely, made up of calcareous algae that they clearly merit the appellation of "nullipore" reefs rather than the time-hallowed, popular, but scientifically misleading designation of "coral" reefs.

Coral reefs have suffered from being early connected with a theory in such an intimate and intriguing fashion as to invite attack against the protagonists of theory rather than to stimulate unprejudiced study of reef history from the point of view of a symbiotic entity, such as, for example, its origin, its growth, its capacity for assuming and retaining definite morphologic form, as well as for morphologic change, its ability to regenerate and to reproduce itself. Any symbiotic aggregate, having unity in general habit, controlled by a certain dominant organism or certain dominant organisms, behaves as an ecologic unit and is designated as a formation. When a formation, because of the environmental factors controlling it, borders or encircles, even irregularly, the substratum of its habitat, it becomes a zonal or zonational formation, and it, as has been pointed out by various writers, but by Clements in particular, is an epitome of succession.

Zonal formations are well known in both animal and plant ecology. The "coral" reef, to use the general term in the abstract, but without prejudice, may be made up entirely of calcareous algae, as Rose Atoll or Onoatoa Atoll, or of both, as Funafuti Atoll, the barrier reef about Tahiti, Moorea, etc., or the exposed fringing reefs of Tahiti, Tutuila, etc. It seems impossible to imagine any "coral" reef, other than certain small "reef patches," being constructed absolutely of corals alone, since even the most important of

[1] Delivered before the Pacific section of the Botanical Society of America, at Pomona College, California, June 15, 1928.

"reef-forming corals" have little or no coherence (or adherence) with one another and no controlling influence as to reef-form production, but are passive symbionts, important at times and in certain types of reef as constructional material, but of equal importance as to whether they are incorporated into the growing structure as massive, resistant masses retaining their position of growth, or as rubble or sand, after partial or complete disintegration.

The "coral" reef symbionts, as classified in the decreasing order of importance by the Coral Reef Committee of the Royal Society in the studies of Funafuti Atoll, are (1) calcareous algae, (2) foraminifera, and (3) corals. What is the reason for placing the calcareous algae first? This was first brought forward by Stanley Gardiner (1903). It was emphasized and made more definite by Finckh (1904) and by others of the Funafuti Committee, and it was cast into definite form by Marshall A. Howe (1912). The dominance of certain types of calcareous algae in bringing about the zonal formations we call coral reefs is evident when we consider the living portions of any coral reef which is still actively growing. The crustaceous calcareous algae, or nullipores, are the binding or cementing agents, the active symbionts, in reef formation. The foraminifera and the corals contribute much less than the algae, even of the bulk of a "coral" reef and add little to its amalgamation into permanent form. They are passive symbionts, disintegrating and dispersed, unless overgrown and united to other aggregates by the nullipores. Were time allowed, this feature might be considered in detail, but Finckh, in particular, in the Funafuti report, has drawn a vivid picture of this interaction.

The active symbionts, the nullipores, are either surface or subsurface workers. The surface workers are sun-loving and surf-loving plants, heliazophytes and spumatophytes in ecological classification. The subsurface active symbionts of a coral reef are shade-loving, current-loving plants, skiarophytes and rheophytes in ecological classification. The cooperation of the first group with the similar heliazobionts and spumatobionts of other plant and animal groups for surface work and the cooperation of the second group with other skiarobionts and rheobionts of other plant and animal groups, bring about reef formation at various depths from the surface down to at least two thousand feet below the mean level of the ocean. Again, it would be desirable to proceed to detail, but time limits forbid. The various reports of the Funafuti Committee furnish much of the available data.

The growing region of an active reef is along its exposed outer edge and flank, since both light conditions and water in motion exist here in most favorable intensities for the growth of both active and passive symbionts. This fact has long been recognized. Even at considerable depths, currents exist, as has been shown by Bigelow for the Challenger Bank off Bermuda and by Stanley Gardiner off the Maldives in the Indian Ocean. The light conditions in clear tropical waters allow red algae of the Nullipore type to flourish down to two thousand feet or below. The temperature relations seem fairly definite and active "coral reef" formation seems to be confined to strictly tropical waters of 25° C. isocryme, or over, at the surface.

"Coral" reefs are formed, either around islands or island groups (usually volcanic) or project from submerged mountain tops. In all cases the formation is zonal. The division into fringing, barrier and atoll types is purely physiographic, the form being in all cases zonal. The interconvertibility of these zonal types, beginning with fringing, passing over into barrier, and thence into atoll has been postulated as a *necessary sequence* in the Darwinian theory of the origin of coral reefs, and as a result of the assumption that coral reefs, excepting only those of the fringing type, can not have been formed other than as a concomitant of *gradual and successive* subsidence of the substratum. Back of this assumption of gradual and successive subsidence, Darwin had two subsidiary ideas. The first, considered proven, dealt with depth limitation of reef-forming corals to about two hundred feet, while the second assumed as improbable the existence of substrata at such uniform depth below the surface and in such numbers as to account for the multitude and wide distribution of atolls. Since the study of typical reefs has relegated the reef coral to the subordinate position of passive symbiont and has indicated that reefs of the atoll type, the most difficult type to account for, are not necessarily dependent upon corals even as passive symbionts, the Darwinian factor of depth limitation ceases to have its extreme inhibition and obviates the *necessity,* at least, for assuming interconvertibility.

That reefs, even of large size, have carried on their development under still-stand conditions of ocean level not only for great lengths of time but also even from the beginning of their formation, seems to me to be clear in the case of those which are still living as reefs, and which show by their present level and the relation of this to the extent and position of their surface controlling nullipore. The barrier reef, and the protected fringing reefs within this, of Tahiti, show this conclusively. The details I have published in my phytogeographical notes on Tahiti (1926). In surface level, the protected fringing reef is the same as the barrier, although now dead as a reef. The barrier reef without it, separated from the fringing reef by a moat (or "lagoon") of varying

width up to half a mile, and a depth averaging about twenty fathoms, still shows a broad outer belt of living pavement nullipore controlling its growth. This belt of pavement nullipore is about fifty meters wide and is extending slowly at not over a rate of one third to one fifth mm per year. The belt of living nullipore, covering at this time only about one third, if as much as that, of the surface of the barrier reef, indicates that the surface of the barrier has remained at the same level for many thousands of years. The dead surface of the barrier and the present dead surface of the now protected fringing reef within it indicate a continuation of this same level since the original fringing reef was extending outward until the rising barrier reef without it shut it off from the surge so necessary to the life of its pavement nullipore and killed it off, taking over the outward extension of the encircling reef structures of Tahiti. Earlier stages of the same process are seen on some sectors of the Tahiti coast where exposed fringing reefs are still provided with controlling pavement nullipores, while the future barrier reefs are still growing upward, but, even yet, are still several fathoms below the surface, thus allowing the waves to pass over them and to supply the vital surge to the fringing reefs within.

I realize the difficulty of making these matters clear and reenforcing them sufficiently in the time allowed, but I trust that I have justified my action in bringing before an assembly of botanists this aspect of the coral reef problem, *viz.*, that the so-called "coral" reef is a biological formation, controlled and moulded into zonal form by its plant symbionts; that the factors of light, aerated water and temperature control its dominant type of symbiont; and that depth limitation and interconvertibility, together with the assumption of the necessity for gradual and continuous subsidence, must be judged not from coral behavior, but from the relations of the controlling nullipores to their environmental factors. From such studies it seems fairly well indicated that reefs of all three physiographic types not only may, but do, develop to their full expression under still-stand conditions of ocean level.

WILLIAM ALBERT SETCHELL
UNIVERSITY OF CALIFORNIA

SCIENCE AND THE PRESS

(Continued from page 100)

THE chairman next called upon Mr. David Dietz, science editor of the Scripps-Howard newspapers, who gave the following address:

SCIENCE, THE NEWSPAPER AND PROGRESS

I regard it a great privilege to be asked to take part in this symposium to-day upon the relationship which should exist between science and the press, for I regard the spirit which has motivated the organization of this symposium as one of the most important in the world to-day. It is a spirit which makes one hopeful for the future.

It is a new spirit and the very fact that it exists betokens the existence of a new point of view both in the field of science and in the field of journalism. I doubt very much if a symposium such as this would have been possible twenty years ago. In all probability, a majority of scientists would have felt at that time that the subject was neither fit nor proper for inclusion upon the agenda of a scientific convention. They would have regarded it as unethical in all probability. Certainly, they would have regarded it as undignified. Newspaper men for the most part would have had little interest in being invited to take part in such a symposium. Those were the days when science was synonymous with ten-syllable ununderstandable words to be treated appropriately by the staff humorist and the cartoonist.

But the point of view has changed in both fields, not only to the mutual benefit of both science and journalism, but to the infinite benefit of the general public as well. The first newspaper publisher to see the necessity of this new point of view was that great far-sighted genius of the newspaper world, E. W. Scripps, the founder of the Scripps-Howard newspapers. After a number of conferences with the leading scientists of the nation, Mr. Scripps organized and endowed Science Service as an agency to gather and disseminate scientific news.

The thing which Mr. Scripps and those scientists who met with him saw was that progress would be immeasurably retarded without the quick and widespread dissemination of scientific thought.

There had been a tendency upon the part of the scientist to withdraw into the seclusion of his laboratory or his library not unlike a hermit in his cave. This action proceeded in every case from the highest and finest motives and is easy to understand. The scientist felt that in searching for the answer to his particular scientific problem he was devoting himself to the most important thing of which he knew. He felt, therefore, that nothing else mattered.

But gradually the feeling became stronger and stronger that something else did matter. This point of view that something else did matter was expressed in a clearer and more powerful way than I am capable of expressing it by Professor James Harvey Robinson in December. 1922, at a symposium at the

annual convention of this association. This other thing which Professor Robinson said was needed was, in his words, the humanization of knowledge. He said that it was not enough to find out facts and write them down in scientific treatises for other scientists. It was his feeling that scientific discovery and thought must be made the property of all people.

A somewhat similar thought was expressed in a newspaper interview a year later at the Cincinnati meeting of this association by Dr. Burton E. Livingston, the permanent secretary. Dr. Livingston said then that it was his opinion that sufficient progress had been made by the scientist and the engineer to insure the complete happiness of the whole world if every scientific discovery had been put to its best possible use. But, as he pointed out, this had not been the case. Many of the discoveries of the scientist have come under the control of others and have been put to their worst possible use. It is the realization of such things as this which has led to the new point of view upon the part of the scientist.

The scientist to-day feels that his work offers the world more than the raw material out of which engineers can fashion the devices of applied science, automobiles, radios and airplanes. The scientist feels that in his work are to be found also the raw material for improving the conditions of the world, for making men happier and healthier as well as for making them more efficient.

Scientists, therefore, are eager to do what is implied in the title of to-day's symposium, bring science to the people. And, as the different papers in the symposium suggest, there are a variety of ways of doing it.

Many universities have introduced special courses, particularly for freshmen, to acquaint the students with the aims and spirit of science. Such courses are frequently termed orientation courses. The University of Chicago and many other universities now have such courses. Many universities are also introducing courses in general science with the aim of giving the student who is not intending to follow a scientific pursuit the general knowledge and background of science which every man who considers himself educated ought to have in this scientific era. At the present time, I am teaching such a course in general science at Cleveland College of Western Reserve University. Public school officials are also considering the advisability of introducing more courses into science in the high schools and junior high schools, and they are even wondering whether a beginning can not be made by the teaching of science in the grammar grades.

But important as all these things are, they are not sufficient to meet the situation. More of the population than that within college walls must be reached. And we can not wait for the present generation of children in the schools to grow up. The great body of men and women carrying on the affairs of the world must be reached.

The remaining agencies through which this can be done are the organization of colleges holding classes at night to offer opportunity of study for adults and the organization of discussion groups and other adult educational movements, and finally the printed word. The field of the printed word might be divided into that of the book, the magazine and the newspaper.

Of these, I sincerely believe that the newspaper is the most important. Perhaps you will smile and say that as a newspaper man I might have been expected to say that. But I shall try to give you my reasons for that belief.

It is first of all the fact that the newspaper reaches so many more people and with such greater regularity. A college may number its students in the thousands. A magazine may have thousands of readers. But a metropolitan newspaper will have a hundred thousand readers or perhaps double that number. Two years ago, I wrote a series of articles based on a month's visit to the Mt. Wilson Observatory in California and the Desert Laboratory in Arizona. The series was syndicated to approximately two thousand newspapers. Their combined circulation was forty-one million readers.

I do not mean to detract from the influence of the other agencies which I have mentioned. They are agencies with which the better grade of newspaper feels honored to cooperate. I believe, in fact, that one of the things which will happen in every city where the newspaper rightly fulfils the function as a disseminator of scientific news will be an increase in the subscriptions to scientific magazines, an increase in the sale of books on scientific subjects and an increase in the popularity of adult education movements.

I said at the beginning of this paper that there was a changed point of view on the part of both the scientist and the newspaper man. It should be added that the last ten years has also brought about a decided change upon the part of the public. Never in the history of the world has the public been so eager for scientific information as it is to-day.

The rapid development in recent years of the application of scientific principles has brought this about. The average man to-day rides in an auto, uses the long distance telephone, has a home equipped with a radio. He is surrounded by a host of twentieth century marvels, the airplane, television, gigantic skyscrapers, and so on. He has a new interest in his personal health and in the problems of public health.

His mind has been stimulated by all these things and as a result he wants knowledge. He wants to know what makes the radio work, what keeps the airplane up in the air, what the secret of television is. He wants to know all about vitamins and ultra-violet radiation and the other discoveries of science which affect his life and his health.

The important question from the practical standpoint then is how are the scientist and the newspaperman to cooperate most efficiently in order that the public may get the scientific information which it wants and which it ought to have. As a newspaperman, I am going to tell you what as scientists you ought to do. I am also going to try to tell you what you have a right to expect in return from the newspapers.

As regards the annual meeting of the American Association for the Advancement of Science, I have no suggestion to make concerning the press arrangements for the meeting other than that you continue to handle the situation exactly as you are doing it. I know that the other newspaper men who have attended these meetings will agree with me that Mr. Austin H. Clark has done an admirable job of managing the press bureau and I know that they will join with me when I say that I hope you will persuade him to continue in charge of the bureau.

Further than that, I can only repeat the plea which your own officers have made to you that you cooperate with the press bureau to the utmost, particularly by sending in copies of papers which you intend to present at the meeting as far in advance as possible.

The fact that newspapers have generally given the meetings of this society such full coverage is the direct result of your efficient press bureau. I wonder if you have ever attempted to visualize the task of the newspaperman at one of these meetings. There are twenty or more section meetings in progress at one time. Some of them are more than a half a mile apart. Frequently, three or four of the papers which the newspaperman is most eager to report upon will be delivered all at the same time. Obviously, the newspaperman could only do an inadequate job if copies of papers were not available for his perusal at the press bureau.

Regarding every other scientific society and association in the United States, I would urge upon them that they adopt the policy of the American Association for the Advancement of Science in this matter. You might at first think that in the case of a small society where only a single session is held this would not be important. But it is. Frequently the most important paper of a session will come near the close of a session. Let us say that such an important paper is read at 11 A. M. The reporter for an afternoon newspaper where the edition goes to press at noon is at a decided disadvantage in attempting to report that paper. If a copy of it had been available to him at 9 A. M., that difficulty would have been obviated. The scientist ought also be interested in making his paper available for the newspaperman, for the danger of being misquoted is completely eliminated in such a case.

I would also like to say a word about the preparation of abstracts for the publicity bureau. An abstract should in all cases be a statement of the material in the paper itself, not an outline telling the type of material which the paper discusses. For example, an abstract which says, "This paper deals with some phases of the relationship between sunspots and the weather," is of no value to the newspaperman. The abstract should say, "This paper details a series of experiments from which the writer concludes that there is no direct relation between sunspots and the weather. The experiments were as follows, etc., etc." In other words, the abstract must be definite and must express the conclusions of the scientist to be of any help to the newspaper man.

Turning now from scientific associations and societies to such organizations as universities and scientific institutions, I would say that every such organization ought to have a person on its staff whose duty it is to deal with the newspapers. This publicity secretary, or whatever title is given him, ought to be a person with a clear understanding of newspaper methods and a sympathetic attitude toward the newspaper.

The publicity secretary should not get the idea that his sole duty is to prepare written statements for the newspapers to publish. In fact, he will fulfil his duties completely only when he acts as the agent through which frequent interviews between the newspaper men and the scientists are arranged.

The individual scientist in universities and other scientific organizations should consider the granting of newspaper interviews, when the occasion warrants them, as one of his important duties to the public. I think a majority of the leading scientists have this point of view to-day.

There are some, of course, who do not. Some months ago, I was told of the head of an important scientific department in a big university who refused to see newspaper men. I made it a point to find out his reasons. He said that he had given out an interview twenty years ago and had been misquoted and consequently had refused to see all newspapermen since. I wonder what this scientist would say if one of his assistants came in to him and said that he had discovered a marvelous new cure for all disease and that he knew his preparation was right because

twenty years ago he had tried it out in one experiment. The scientist who draws into a shell because of something that happened twenty years ago is not acting in a scientific manner, to put the case mildly.

And now, finally, what has the scientist to expect from the newspaper man if he gives that individual the consideration and courtesy which I have suggested?

He has the right to expect precisely the same sort of consideration and courtesy in return.

First of all, the scientist has the right to expect that the newspaper editor will assign a reporter to cover the meeting or obtain the interview who has some understanding of the fundamentals of science and who is sympathetic to science.

He has the right to expect that the reporter will report what he says accurately, intelligently and fairly.

On this score, however, I do not think that the scientist need have any particular concern. As I said at the start, the best newspapers of the nation already realize this. They are eager to report science accurately and intelligently. Many of them now have reporters who specialize in the reporting of scientific news.

I believe that with the passage of time all newspapers will come to this point of view.

I believe that in any city where a scientific institution or university feels that a particular newspaper has the wrong point of view, a friendly conference between the heads of the institution and the editor of the paper will do much to right the situation. Nothing leads more quickly to cooperation than first-hand acquaintanceship.

The things which I have enumerated are all relatively simple things. It is important, however, that they be done well. And I believe that they are things exceptionally well worth doing well. For I believe that they are the most effective means by which scientific knowledge and the spirit of science can be diffused throughout the nation.

At the conclusion of Mr. Dietz's address, the chairman called upon the science editors of the Associated Press, and Mr. Coleman B. Jones presented the following paper, prepared jointly by himself and Mr. John L. Cooley.

SCIENCE AND THE PRESS ASSOCIATION

This is an instructive occasion. It is a pleasure to sit in at the first symposium of scientists and newspaper men, and a privilege to participate.

A few years ago the organization of such a conference as this would have been extremely difficult, if not impossible. A few months ago it would have been clearly impossible for us to take part because the great organization of newspapers which we represent had not then undertaken to extend its vast resources and facilities to an intensive investigation of the activities of science.

The Science News Service of the Associated Press was introduced six weeks ago through the Associated Press feature service in response to the growing demand of the public for more complete knowledge of the interesting and vital accomplishments of the scientific world.

When it was organized, a few weeks earlier, the question naturally arose whether to place its development in the hands of men trained in the sciences or of men trained primarily in writing for the public. The latter course was determined upon, so we were called in and given the assignment, our chief qualifications being that we knew that science was interesting and that we did not know too much about it.

In announcing the new service to the twelve hundred newspapers which are members of the association, Mr. Kent Cooper, the general manager, and Mr. Lloyd C. Stratton, the general feature editor, expressed their recognition of the field of science as an absorbingly interesting and increasingly important ally of human and industrial progress.

"All phases of scientific endeavor," they said, "will come under the scrutiny of these scientific assignment writers, who each week will give members of the feature service a page of live, interesting and popularly prepared news features concerning the latest developments and discoveries of the scientific workroom.

"When noted scientists gather for their meetings and conventions, A. P. men will be on the spot to report the messages. They likewise will cover any of the noteworthy experiments in current scientific circles.

"The Science News Service of the Associated Press expects to take readers behind the scenes that are daily being shifted in the laboratories of the large educational, endowed and industrial plants of the country. Whatever may be the branch of science or whatever may be the story, it will be the purpose of this service to inform newspaper readers of the experiments and proven facts in the growth of science."

So here we are.

We are here to help the public reach a clearer and broader understanding of the efforts of science to make life easier and safer and more comfortable for mankind. We are here to help science carry its amazingly interesting message to the public which, more and more, is becoming its main support. It is a pleasant task.

Mechanically, we have to help us in the spreading of the news of science a vast network of leased tele-

graph wires and a full eight-column page distributed each week by mail throughout the country in the illustrated feature service of the organization.

The Associated Press has been recognized for many years as the most successful cooperative organization in the world. It is an association of newspapers having individual and frequently conflicting editorial policies but banded together for the exchange of news by wire and mail so that each may give its readers, as nearly as possible, a complete record of the significant events of each day.

Accuracy has become, perhaps, the most widely known of the characteristics of the Associated Press. There have been times when it was accused of dullness —whether justly or unjustly depends upon the individual critic's opinion as to what is dull and what is interesting. At any rate, such times when the accusation might have had a touch of justice in it are definitely past. For it has long since been recognized that news and feature stories can be written with a view to bringing out their full flavor of human, dramatic or humorous qualities without sacrificing anything of accuracy and dignity. It is, of course, possible to write interestingly of any subject without being accurate, but it is not possible to get that desired effect without dignity, which, in writing, means *verisimilitude* and embraces the qualities of poise and insight. Possibly, however, it might be well to call upon the science of psychology for an accurate definition of dignity, and to qualify the one just given by saying that it is our definition of the word and leave it at that until we can know more about it.

With the traditions of the Associated Press for our foundation, we who have been assigned the task of covering the news of science are building up what, if we were scientists instead of newspaper men, we might call a special technic. Of course, it is not especially new, but its elements appear to require greater emphasis in this field, where we are dealing with the nation's most thoughtful men and women.

The fundamental elements of that "special technic" are, after all, precisely the same as are the fundamental elements of all sound news writing: brevity and lucidity, as well as accuracy and dignity. Jazz writing, commonly associated with tabloid journalism, is not merely absent, but repugnant. Brevity is essential because the average newspaper could not, even if it were wise to do so, provide space for all details of every event it records. Without lucidity, a story might as well be left unwritten, for its purpose is to reach the undertsanding of readers. An account of a scientific experiment or achievement, for instance, may be written in technical terms and still be perfectly lucid if it is to be published in a journal circulating only among readers who understand its terms. But for a newspaper, it would not be lucid until translated into the common language. It is our function to put the facts of science into the common language with just as much accuracy as if they were written in the symbols of science and to show that they are just as interesting as the public love affairs of more or less psychopathic ladies.

Possibly in the past the reporter has misunderstood and misrepresented the scientist, and perhaps the scientist has been too suspicious of the news gatherer. The one may have antagonized the other.

Thanks to the rapprochement effected between them —due in no small part to the splendid work of Mr. Austin H. Clark, news manager of the American Association for the Advancement of Science, and his associates—the scientist who says "What I am doing is none of the public's business" is seldom encountered to-day. Instead, he is sitting down with the reporter and explaining his work to the public, whose welfare is his ultimate concern. Likewise, the newspaper man of to-day is less likely than many of his predecessors to view science as the source of funny, freak stories.

The newspaper is the diary of the race, and the press association, through its far-flung contacts, makes most of the major entries in that journal. Its responsibility is tremendous, for unless the record is truthful, it might better not be kept.

We have assumed our small share of the work of scientific news reporting with the knowledge that we have the support of the newspapers and that they want us to give them an accurate reflection of what is being done by the men and women who are giving their lives to search for the ultimate truth. We assure you that we are approaching the task before us with a full sense of its importance to the scientist and to the public, and we trust that we shall have your cooperation in carrying the messages of the laboratory to the homes of our country.

The chairman then called upon Mr. Frank Parker Stockbridge, who spoke informally on the collection of scientific material and its presentation from the point of view of the feature writer.

Dr. William E. Ritter, of Science Service, gave his impressions of some of the difficulties attending the popular exposition of scientific material and suggested ways by which these could be overcome.

The remarks of the several speakers gave rise to considerable discussion, which at times became quite animated.

AUSTIN H. CLARK

U. S. NATIONAL MUSEUM,
WASHINGTON, D. C.

POPULAR PROGRAM OF THE NEW YORK MEETING OF THE AMERICAN ASSOCIATION

AN attractive week-end program has been arranged for the New York meeting of the American Association for the Advancement of Science and Associated Societies, December 27, 1928, to January 2, 1929. President Henry Fairfield Osborn, Honorary Chairman Michael I. Pupin, Chairman George Braxton Pegram and Secretary Sam F. Trelease are cooperating with the Washington office and the secretaries of sections and societies to make the week an outstanding scientific event, with Sunday, December 30, as a special feature rather than a gap in the program.

On Sunday many of the city's most delightful privileges, rarely available to New Yorkers themselves, will be hospitably open to members attending the scientific meetings of Science Week. Excursions for members interested in the several well-known scientific institutions in the environs of New York, listed below, will take place in the morning. In the afternoon the association and its associated societies will be the guests of an anonymous friend at a gift concert of the famous Philharmonic-Symphony Society to be held in either Carnegie Hall or the Metropolitan Opera House. In the evening the trustees of the Metropolitan Museum of Art, setting aside all precedent, will tender a reception in their magnificent building to the conferring scientists. This gracious act is a most rare and eagerly sought concession and completes Sunday as a gala day in the midst of a week of specialized scientific meetings, which culminate each evening in a fine address upon the broad aspects of present-day work in one of the main fields of science.

These evening addresses, extending from December 27 to January 2, and several afternoon addresses, have been carefully chosen by President Osborn to be of general interest to all scientists as well as to non-technical listeners. The speakers selected are among the best this country affords. The addresses will be delivered in the large auditorium of the American Museum of Natural History and will be followed each evening by a reception, especially to students and workers in the field covered by the address, to be held in Education Hall of the Museum and in the pertinent exhibition halls.

This special association program as arranged to date by President Osborn includes:

EVENING ADDRESSES

Thursday, December 27: Special addresses of welcome, followed by Professor CHARLES P. BERKEY, of Columbia University, on "Recent Discoveries in the Geology of Mongolia."

Friday, December 28: The seventh annual Sigma Xi lecture, Professor ARTHUR H. COMPTON, of the University of Chicago, on "What is Light?"

Saturday, December 29: Professor WILLIAM MORTON WHEELER, of Harvard University, on "New Tendencies in Biologic Theory."

Sunday, December 30: Afternoon concert by Philharmonic-Symphony Society. Evening reception at Metropolitan Museum of Art.

Monday, December 31: Retiring President Arthur A. Noyes, on the "Story of the Elements."

Tuesday, January 1: Special feature address on "Astronomy." To be announced later.

Wednesday, January 2: Popular evening address, subject to be announced later.

AFTERNOON ADDRESSES

Professor FRANZ BOAS, "Migrations of Asiatic Races and Cultures to North America."

Professor FRANK B. LEVERETT, "Glaciations of the Northern Hemisphere."

Professor BAILEY WILLIS, "Mountain Building, Metamorphic Orogenesis."

Besides these special features there will be, as usual, a number of other general sessions of the American Association and numerous joint sessions by groups of societies. A meeting of special interest is being arranged by Dr. Rodney H. True, secretary of the association's committee of One Hundred on Scientific Research. This session, including papers by several eminent men, will be devoted to a discussion of the economic status of research workers. The annual exhibition of apparatus and materials for research and teaching in science, of scientific books and periodicals, and of newly developed research methods, will be an important feature of the New York meeting. It will be open daily in the Gymnasium of Columbia University, where the very successful exhibition of the last New York meeting was held. Research workers, wishing to present exhibits or to suggest other possible exhibitors, are asked to communicate with the permanent secretary's office in Washington.

COOPERATING LOCAL INSTITUTIONS

Local institutions cooperating with the local committee in extending a welcome to the American Association, with the special representative appointed by each, are:

American Chemical Society, New York Section, *Secretary S. P. Burke;* American Geographical Society, *Director Isaiah Bowman;* Museum of the American Indian, *President George G. Heye;* American Museum of Natural History, *Director George H. Sherwood;* American Telephone and Telegraph Company, *Vice-president F. B. Jewett;* Barnard College, *Dean Virginia C. Gildersleeve;* Boyce Thompson Institute for Plant Research, *Director William Crocker;* Brooklyn Institute of Arts and Sciences, *President Frank L. Babbott.*

Department of Genetics (Cold Spring Harbor) of the Carnegie Institution of Washington, *Director Charles B. Davenport;* Casa Italiana, of Columbia University, *Professor John L. Gerig;* Chamber of Commerce of the State of New York, *Vice-president Charles T. Gwynne;* Chemical Foundation, *Adviser Charles H. Herty;* American Society of Civil Engineers, *Secretary George T. Seabury;* Columbia University, *Secretary Frank D. Fackenthal;* Cooper Union for the Advancement of Arts and Sciences, *Secretary Percy R. Pyne;* Cornell University Medical College, *Dean Walter L. Niles;* American Institute of Electrical Engineers, *Secretary F. L. Hutchinson;* Engineering Foundation, *Director Alfred D. Flinn;* Fordham University, *Dean Charles J. Deane,* S.J.; General Electric Company, *President Gerard Swope.*

Hispanic Society of America, *President Archer M. Huntington;* Horace Mann School, *Head Master Rollo G. Reynolds;* International Education Board, *President Wickliffe Rose;* International House, *Secretary Harry Edmonds;* Lincoln School, *Head Master Jesse H. Newlon;* Biological Laboratory of the Long Island Biological Association, *Director Reginald G. Harris;* Long Island College Hospital, *Dean Adam Miller.*

American Society of Mechanical Engineers, *Secretary Calvin Rice;* New York Academy of Medicine, *Director Linsly R. Williams;* Merchants Association of New York, *President Lucius R. Eastman;* Metropolitan Museum of Art, *President Robert W. De Forest, Secretary Henry W. Kent;* Mining and Metallurgical Engineers, *Secretary H. Foster Bain.*

New York Botanical Garden, *Director N. L. Britton;* College of the City of New York, *President Frederick Robinson;* New York Department of Health; New York Historical Society, *President John Abeel Weekes;* New York Post Graduate Medical School and Hospital, *Dean William D. Cutter;* New York Telephone Company, *Vice-president J. L. Kirkpatrick;* New York University, *Professor R. W. Renshaw;* New York Zoological Society, *Director W. Reid Blair;* Hotel Association of New York.

College of Physicians and Surgeons, *Dean William Darrach;* Postal Telegraph Cable Company, *Secretary Chester G. Burden;* Princeton University, *Professor Arthur Conklin;* Rockefeller Institute for Medical Research, *Manager Edric B. Smith;* Radio Corporation of America, *President James G. Harbord;* Russell Sage Foundation, *General Director F. M. Glenn;* New York Academy of Sciences, *Secretary Roy Waldo Miner;* Stevens Institute of Technology, *President Harvey N. Davis;* Teachers College, *Dr. Goodwin B. Watson;* University of the State of New York, *Commissioner Frank Pierrepont Graves;* Museum of the State of New York, *Dr. Charles C. Adams;* Western Union Telegraph Company, *Vice-president G. M. Yorke;* Yale University and the Peabody Museum, *Professor Richard S. Lull.*

Other invited individuals and institutions from whom acceptances are very shortly expected include: Mayor James J. Walker, of the City of New York; Hunter College, Adelphi College of Brooklyn, New York Edison Company, Union Theological Seminary, United States Steel Corporation, Museum of the City of New York, Bellevue Hospital Medical College.

Press Cooperation

The press will be exceptionally well represented at this meeting. The news service of the association, in charge of Austin H. Clark, of the U. S. National Museum, will facilitate contacts between the press representatives and the scientists and will prepare in advance press releases of material to be presented in the various sessions. All who are to take part in the programs are asked to send, as soon as possible, two copies of manuscripts and abstracts of their addresses and papers to Mr. Clark at the national office of the American Association in the Smithsonian Institution Building, Washington, D. C.

The following press organizations have signified their desire to help to extend the influence of this meeting throughout the country by their respective channels: New York *Times, Herald-Tribune, The Sun, Journal of Commerce,* New York *World,* New York *Staats-Zeitung, The Christian Science Monitor, The Times* (London), Associated Press, New York City News Service, New York World News Syndicate, Amalgamated Press, Science Service, *Literary Digest, Scientific American, Popular Science.*

Meeting Places

The meeting places of the sections and associated societies have been assigned by Chairman George B. Pegram as follows:

At the American Museum of Natural History, 77th Street and Central Park West: Receptions, general sessions, evening and afternoon addresses of general interest; Section E (Geology and Geography), Geological Society of America, Society of Economic Geology, Paleontological Society of America, Mineralogical Society of America; Section H (Anthropology), American Anthropological Association, American Folk-Lore Society; American Society of Naturalists.

At Barnard College of Columbia University, Broadway at 119th Street: Section A (Mathematics), American Mathematical Society, Mathematical Association of America.

At the Physics Laboratories of Columbia University, Broadway at 120th Street: Section B (Physics), American Physical Society, American Meteorological Society, American Astronomical Society.

At Schermerhorn and Fayerweather Halls of Columbia University, 118th Street at Amsterdam Avenue: Section I (Psychology), American Psychological Association.

At the School of Business of Columbia University, Broadway at 116th Street: Section K (Social and Economic Sciences), Metric Association.

At the School of Mines of Columbia University, Broadway at 117th Street: Section L (Historical and Philo-

logical Sciences), Linguistic Society of America, History of Science Society.

At Teachers College of Columbia University, Broadway at 120th Street: Section F (Zoological Sciences), American Society of Zoologists, Entomological Society of America, American Association of Economic Entomologists, American Society of Parasitologists, Phi Sigma Biological Research Society; Section G (Botanical Sciences), Botanical Society of America, American Phytopathological Society, American Society of Plant Physiologists, Sullivant Moss Society, American Fern Society, Ecological Society of America, American Microscopical Society, Genetics Sections of the American Society of Zoologists and the Botanical Society of America, Geneticists Interested in Agriculture, American Nature Study Society; Section O (Agriculture), American Society of Agronomy, Potato Association of America, Society of American Foresters; Section Q (Education).

At the Engineering Societies Building, 29 West 39th Street: Section M (Engineering).

At the American Geographical Society Building, 156th Street and Broadway: Association of American Geographers, National Council of Geography Teachers.

At Rockefeller Institute, 66th Street and Avenue A: Section N (Medical Sciences).

Further information regarding these reservations can be obtained from Chairman George B. Pegram, at Columbia University.

HOTELS

The hotels of New York City have been thoroughly canvassed and very favorable rates secured. These have been communicated to the secretaries of the societies and sections for the selection of headquarters hotels. A list of these, together with prices at about one hundred hotels, will be published in SCIENCE in the near future. Members are urged to make their reservations direct and an early choice of hotels is recommended, as the local committee expects the eighty-fifth meeting of the American Association for the Advancement of Science and its Associated Societies to be the largest in the history of the organization.

HELEN ANN WARREN,
Assistant Secretary to New York Committee on Arrangements
AMERICAN MUSEUM OF NATURAL HISTORY

SCIENTIFIC EVENTS

THE NEW ASTRONOMICAL OBSERVATORY AT STOCKHOLM

STOCKHOLM is to have a new astronomical observatory, to be located at Saltsjobaden, a garden city about 10 miles outside the capital, according to a report from the consul general at Stockholm, John Ball Osborne, made public August 1 by the U. S. Department of Commerce. The building will be started as soon as possible, and it is expected that the observatory will be ready for use in two or three years.

The equipment will include a large refracting telescope for parallax determinations, a large new reflecting telescope, about one meter in diameter and intended for spectrographic observations, astrographs for photometric examinations, and a new meridian circle.

The project has been made possible by the Stockholm municipal authorities offering to purchase the present observatory in the city for the sum of 900,000 crowns (about $421,000) and through a donation of 1,000,000 crowns (about $468,000) from "Knut and Alice Wallenger's Foundation." This foundation was founded in December, 1917, for the purpose of promoting science, etc., and large donations have been made for the establishment of various institutions.

The present observatory in Stockholm, built on a hill in the northern part of the city, was erected during the years 1748 to 1753. However, it is now too small and cramped to serve its purpose, the rapid growth of the city has made the location unsuitable, and the equipment is considered too out-of-date to comply with modern requirements.

THE INTERNATIONAL FUEL CONFERENCE

SEVEN of the ten official delegates who will represent the United States at the Fuel Conference to be held in London from September 24 to October 6, under the auspices of the World Power Conference, have been chosen, according to the *Electrical World*, as follows: Dr. Gustav Egloff, petroleum technologist, Universal Oil Products Company, Chicago, Ill.; H. W. Brooks, consulting engineer, New York City, representing the American Society of Mechanical Engineers and the International Railway Fuel Association; O. P. Hood, chief of the technological branch, U. S. Bureau of Mines, Washington, D. C., representing the American Society of Mechanical Engineers; Martin Frisch, manager of field engineering, Combustion Engineering Corporation, New York City; G. A. Orrok, consulting engineer, New York City, representing the American Society of Mechanical Engineers; David B. Rushmore, formerly consulting engineer, General Electric Company, New York City, member of the executive committee of the American committee, and O. C. Merrill, general chairman of the American committee of the World Power Conference, ex-secretary of the Federal Power Commission.

Among the papers to be presented by Americans are the following, classified by associations represented:

American Institute of Mining and Metallurgical Engineers.—"Pulverized Fuel for Steam Purposes," Martin Frisch and Henry Kreisinger, Combustion Engineering Corporation, New York City; "Pulverized Fuel in Metallurgical Work," W. O. Renkin, Fuller-Lehigh Company, Fullerton, Pa.; "Pulverized Fuel in Marine Works," H. W. Brooks, consulting engineer, New York City.

National Electric Light Association.—"Domestic Heating by Means of Solid Fuel, Oil, Gas and Electricity," H. W. Derry, Union Gas & Electric Company, Cincinnati, Ohio; "Utilization of Electricity for Industrial Heating," W. H. Sammis, Consumers Power Company, Jackson, Mich.

American Institute of Electrical Engineers.—"Utilization of Electricity for Industrial Heating."

U. S. Bureau of Mines.—"Coal Classifications," A. C. Fieldner, Washington, D. C.

THE CURRENT PROGRAM OF THE ILLINOIS STATE GEOLOGICAL SURVEY

THE Illinois State Geological Survey is undertaking the following field and office projects during the current fiscal year beginning July 1, 1928:

The paleobotany and stratigraphy of the Pottsville formation by Dr. David White, in cooperation with U. S. Geological Survey; the paleontology and stratigraphy of the Silurian System by Professor T. E. Savage, of the University of Illinois; the physiography, stratigraphy and paleontology of the Pleistocene System of southern Illinois by Professor Paul MacClintock, late of the University of Chicago, now of Princeton University; the paleontology of the Pennsylvanian System by Dr. J. Marvin Weller, of the state survey staff; the foraminifera of the Pennsylvanian System by Professor C. O. Dunbar, of Yale University, assisted by Mr. L. G. Henbest, of the survey staff; the flora of the coal balls by Associate Professor A. C. Noé, of the University of Chicago; the writing of the new report on the fluorspar deposits of Hardin County by Professor E. S. Bastin, of the University of Chicago; the writing of a comprehensive bulletin on the Illinois Coal Field by Dr. G. H. Cady, of the state survey staff; the writing of the report on the oil and gas possibilities of northern Crawford County by Mr. G. F. Moulton, of the survey staff; the writing of the report on the oil and gas possibilities of the Hardinsville and Sumner quadrangles, by Assistant Professor D. J. Fisher, of the University of Chicago; the economic non-metallic resources of extreme southern Illinois by Mr. J. E. Lamar, of the survey staff, and Mr. C. E. Dutton, of the University of Illinois; the writing of the report on the Monmouth quadrangle and the collecting and interpretation of sub-surface data in the state by Mr. L. E. Workman, of the survey staff; the geology of state highway engineering projects and the writing of the report on the Kankakee quadrangle by Dr. G. E. Ekblaw, of the survey staff; the geologic mapping of the Illinois portion of the Hardin and Brussels quadrangles by Mr. W. W. Rubey, loaned to the state survey by the U. S. Geological Survey, assisted by Dr. J. R. Ball, of Northwestern University; the geologic mapping of the Winchester and Griggsville quadrangles by Dr. A. H. Bell, of the survey staff; the geologic mapping of the Glasford quadrangle by Dr. A. C. Bevan, of the University of Illinois; the writing of the report on the Havana quadrangle by Dr. H. R. Wanless, of the University of Illinois; and the geologic mapping of the Elgin quadrangle by Dr. M. M. Leighton, chief of the Illinois Geological Survey, and W. E. Powers, of Northwestern University.

Geological assistants, chiefly graduate students, of some of the foregoing parties include H. B. Willman, O. E. Wagner and S. E. Ekblaw, of the University of Illinois, E. R. Fritz and K. W. Stott, of the University of Chicago, and T. A. Hendricks, of Northwestern University.

The State Board of Natural Resources and Conservation, which controls the policies and activities of the state scientific surveys, including the geological survey, recently confirmed the appointment of Curator F. C. Baker, of the museum of natural history of the University of Illinois, as consultant in Pleistocene invertebrate paleontology. Professor Baker is now engaged in a study of the fossil collections from the various interglacial loesses and water laid silts which the survey is making in its Pleistocene and quadrangle studies.

The printing program of the Illinois Survey now includes, in addition to its regular technical bulletins, an educational series of pamphlets for the educated layman and public school pupil, illustrated and written especially for their kind of interest and background.

The topographic mapping of the state under the immediate charge of Major W. H. Herron, topographic engineer in charge of the Central Division of the U. S. Geological Survey, is continuing with the financial support of $100,000 per year shared equally by the federal and state surveys. The revised topographic mapping of Chicago and vicinity was completed last fall, and the engraved sheets are now being issued in 7½ minute units, vertical interval 5 feet, thus making a remarkable metropolitan map.

DR. SMITH'S COLLECTION OF CHEMICAL MEMORABILIA AT THE UNIVERSITY OF PENNSYLVANIA

As already recorded in SCIENCE, the valuable collection of chemical memorabilia assembled by Dr. Edgar Fahs Smith, who was provost of the University

of Pennsylvania for ten years, has been presented to the university by his widow, Mrs. Margie A. Smith, and will be preserved in its present setting in the Harrison chemical laboratory.

The university is making special arrangements to safeguard the collection. It will continue to be accessible to visitors and students, many of whom during Dr. Smith's lifetime had frequent recourse to it for research work.

The collection comprises three main divisions. The first contains about 500 autographed letters and manuscripts of eminent chemists of all nationalities; the second is made up of approximately 1,000 portrait prints and engravings of prominent chemists from the days of the alchemists to the present, and the third consists of nearly 1,000 books on alchemy and chemistry.

In addition, there are a number of chemical preparations and a variety of apparatus which Dr. Smith had accumulated during his career as teacher and research worker, and an unusually rare collection of books and manuscripts relating to the history of the University of Pennsylvania and the lives of outstanding alumni and members of the faculty.

Of Dr. Smith's books on alchemy and chemistry the majority are in their original bindings and many are printed in Latin, German and old French.

Letters from eminent chemists of all nations from the earliest times down to those of Pasteur and Mme. Curie are among the autographed manuscripts. Notable among these is one addressed by Joseph Priestley in 1792 to the members of the National Assembly of France, declining "nomination to the National Convention."

In 1898, when Dr. Smith was elected vice-provost of the university, he became intensely interested in its early history and his zeal in collecting material bearing on that subject soon resulted in his accumulation of a variety of rare items, many of which can not be duplicated elsewhere.

When the Harrison chemical laboratory was erected at the university in 1894, Dr. Smith selected two rooms for his offices and these he continued to occupy until his death, making them the depository for his collections.

SCIENTIFIC NOTES AND NEWS

PROFESSOR GILBERT MURRAY (England) has been elected president of the League of Nations International Committee on Intellectual Cooperation, in succession to the late Professor Lorentz. Mme. Curie (France) and M. Destrée (Belgium) have been elected vice-chairmen.

PROFESSOR C. W. STILES, of the U. S. Public Health Service, has been elected honorary fellow of the Royal Society of Tropical Medicine and Hygiene.

WILHELM N. SUKSDORF, of Bingen, Washington, was awarded an honorary degree of master of science in botany by the State College of Washington at its thirty-second commencement. It was the first honorary degree awarded by the institution in eleven years.

ALFRED V. DE FOREST, research engineer for the American Chain Company, was recently awarded the Dudley national medal by the National Society for Testing Materials in recognition of his achievement in perfecting a non-destructive test for materials.

SIR D. MORVSON, professor of geology and mineralogy at the University of Adelaide, was awarded the gold Nachtigall medal by the Society of Geography of Berlin, on the occasion of its one hundredth anniversary. The society also awarded a gold medal to the Society of Geography of Paris.

L. BLARINGHEM, professor at the Sorbonne, has been elected a member of the Paris Academy of Sciences in the section of botany, to take the place of the late Professor Guignard.

DR. NAGEOTTE, of the College of France, Paris, has been awarded the Monaco prize of 100,000 francs by the French Academy of Sciences.

ACCORDING to *Nature*, the Russian Academy of Sciences has appointed a committee to arrange for the celebration of the completion of forty years of scientific research by one of its members, Professor P. Sushkin, the eminent zoologist. There will be a special meeting of the academy in October, and it is hoped to publish a jubilee volume of papers.

DR. HANS THIERFELDER, professor of physiological chemistry at Tübingen, has recently celebrated his seventieth birthday.

DR. THOMAS B. OSBORNE, for forty-two years chief in protein research at the Connecticut Agricultural Experiment Station, New Haven, has retired from active direction of the work of the laboratory, assuming the title of advisory biochemist. Dr. Hubert B. Vickery, for several years associated with Dr. Osborne, has been appointed biochemist in charge.

THE retirement of Dr. Robert F. Ruttan, director of the department of chemistry in the medical school of McGill University and dean of the faculty of graduate studies, has been announced.

THE American Society of Plant Physiologists has elected the following officers for 1928–29: *President*, Dr. E. J. Kraus, of the University of Chicago; *vice-*

president, Dr. Scott V. Eaton, of the University of Chicago; *secretary-treasurer,* Dr. H. R. Kraybill, of Purdue University.

OFFICERS for the year 1928–29 of the British Institution of Electrical Engineers have been elected as follows: *President,* Lieut.-Col. K. Edgcumbe; *vice-presidents,* Mr. P. V. Hunter, Dr. A. H. Railing; *honorary treasurer,* Lieut.-Col. F. A. Cortez Leigh.

PROFESSOR BRILMAN, of Denmark, has been elected president of the International Union for Pure and Applied Chemistry, the ninth conference of which came to an end at The Hague on July 21.

AT the ninety-sixth annual meeting of the British Medical Association, held in Cardiff, Dr. A. H. Burgess, of Manchester, was elected president for 1929–30, and Dr. W. Harvey Smith, of Winnipeg, for 1930–31.

DR. J. H. DELLINGER, chief of the radio laboratory of the U. S. Bureau of Standards, has been appointed chief engineer of the Federal Radio Commission for a period of three months, subject to the approval of the secretary of commerce.

J. E. GRAF has been designated assistant chief of the U. S. Bureau of Entomology. He will continue his assignment as leader of the truck crop division and will also be responsible for matters pertaining to the business administration of the bureau.

DR. WILLARD ROUSE JILLSON, state geologist of Kentucky, was reappointed director of the Kentucky Geological Survey on July 11, by Governor F. D. Sampson, for a term of four years.

DR. LOUIS I. HARRIS, commissioner of health for New York City, has been appointed health expert and consultant to the National Dairy Products Corporation of New York.

N. T. NELSON, assistant physiologist in the tobacco substation at Windsor, Connecticut, has resigned to take charge of tobacco investigations under the supervision of the Canadian government at Ottawa.

JOHN STANLEY ROSS, who for several years has been in charge of the U. S. Geological Survey station at Midwest, Wyoming, has accepted a transfer to the Bureau of Mines Station at Dallas, Texas, where he will be employed on gas conservation work.

FRED F. HENSHAW, district engineer for the United States Geological Survey, water resources branch, Portland, Ore., has been transferred to the staff of the Federal Power Commission at Washington, D. C. G. H. Canfield, principal assistant in the Portland district, has been named to succeed Mr. Henshaw.

DR. F. LINDHOLM has been appointed director of the Physical Meteorological Observatory at Davos, to succeed Professor C. Dorno, who retired from active association with the observatory on April 1.

DR. JAMES A. DOULL, associate professor of epidemiology, in the Johns Hopkins University School of Hygiene and Public Health, has been granted a leave of absence to coordinate the work of the five year investigation of "common colds," made possible by a gift from the Chemical Foundation, New York. Dr. Doull's duties will be to maintain contact between the committee and the research workers; he will also engage in the clinical study of colds at the headquarters of the investigation in the Johns Hopkins Hospital.

PROFESSOR JAMES HENRY BREASTED, director of the Oriental Institute of the University of Chicago, has been commissioned by Secretary of State Frank B. Kellogg to represent the United States Government at the seventeenth International Congress of Orientalists to be held at Oxford, England, from August 27 to September 1. Dr. Breasted sailed for England on August 1.

PROFESSOR A. C. SWINNERTON, of the Department of Geology of Antioch College, is spending the month of August in the Bermudas under the auspices of the division of geology of Harvard University, where he is studying the relation of the Bermuda caves to changes in level.

PROFESSOR W. J. BAUMGARTNER, of the department of zoology of the University of Kansas, has been granted leave of absence for one year. He with his family will sail on August 15 for Europe where he will study in the University of Munich. Some time will be spent at the Naples Station and visits to other prominent laboratories in England and France will be made.

DR. ALEXANDER A. WEECH, Baltimore, is to spend a year in Peking Union Medical College, Peking, China, as associate professor of pediatrics.

ACCORDING to press dispatches the Swedish botanist, Dr. Sven Johan Enander, will soon make a trip to the United States, Canada and Mexico for the purpose of collecting trees of the sallow family. The Swedish Riksdag has awarded Dr. Enander a subsidy of $3,215 to help finance his forthcoming trip.

DR. STANISLAW K. KON, of Warsaw, Poland, a fellow of the Rockefeller Foundation, will spend the next month observing work at the Mayo Clinic. He is especially interested in nutrition.

STEPHEN JAROSZ, forester from Posen University, Poland, is studying forest conditions in Mount Rainier National Park.

H. C. SAMPSON, economic botanist at the Royal Botanic Gardens at Kew, will soon sail for British Honduras, where, at the request of the governor, he will carry out an investigation into the suitability of certain areas for agricultural settlement and for the cultivation of products for export.

ACCORDING to the Paris correspondent of the *Journal* of the American Medical Association, the bust of Dastre, the physiologist, who was professor at the Sorbonne, after having been one of the outstanding pupils of Claude Bernard, was recently assigned a prominent place in his former laboratory, and fitting dedicatory ceremonies were organized by his direct successor, Professor Lapicque.

DR. SAMUEL FESSENDEN CLARKE, professor emeritus of natural history at Williams College, died on August 1, aged seventy-seven years.

SIR FRANK SLY, who took a prominent part in the development of agricultural research in India, died on July 16, aged sixty-two years.

PUBLIC lectures will be given at the New York Botanical Garden on Saturday afternoons during August and September at 4:00 P. M. as follows: August 4, "Lilies," Dr. A. B. Stout; August 11, "Phlox," Alfred M. S. Pridham; August 18, "Naturalizing Bulbs," Mrs. Wheeler H. Peckham; August 25, "Summer Flowers Grown from Seed," Kenneth R. Boynton; September 1, "The Japanese Beetle," Loren B. Smith; September 8, "Gladiolus," Wm. Edwin Clark; September 15, "Growing Dahlias from Seed," W. H. Waite; September 22, "Trinidad and the Virgin Islands," Dr. Fred J. Seaver; September 29, "Gardening Books," Dr. J. H. Barnhart.

Nature reports that active preparations are being made for the quadrennial International Congress of Mathematics to be held from September 3 to 10 at Bologna. The business of the congress is to be transacted in seven sections: (1) Arithmetic, algebra, analysis; (2) geometry; (3) mechanics, astronomy, geodesy, geophysics, physical-mathematics, theoretical physics; (4) statistics, mathematical economics, calculation of the probabilities, science of the actuary; (5) engineering and industrial applications; (6) elementary mathematics, didactical questions, mathematical logic; (7) philosophy, history of mathematics. In each section an attractive program of lectures by experts has been arranged. On the social side, the national government and the cities of Bologna, Florence, Ravenna, Ferrara will give receptions. The visits organized will include important engineering works on the Tuscan-Emilian Apennines and the hydro-electric plant on the Lake of Ledro, near Lake Garda. Delegates have been appointed by the Universities of Aberdeen, Belfast, Birmingham, Cambridge, Edinburgh, Glasgow, Manchester, Oxford, St. Andrews and Toronto and Columbia University, the Royal Society of Edinburgh and the Cambridge Philosophical Society.

THE British Medical Research Council has announced that, on behalf of the Rockefeller Foundation, they have made the following awards of fellowships provided by the foundation and tenable in the United States during the academic year 1928–29: Dr. Leonard Ernest Bayliss, Sharpey scholar at University College, London; Dr. Albert Victor Neale, Children's Hospital, Birmingham; Dr. Francis John Worsley Roughton, lecturer in physicochemical aspects of physiology, University of Cambridge; Dorothy Stuart Russell, research worker in the Baron Institute of Pathology, London Hospital, and Arthur Wormall, lecturer in biochemistry, University of Leeds.

RECENT gifts announced by the University of Chicago board of trustees include an increase by Robert Law, Jr., of his subscription to the development fund from $80,000 to $200,000, the total to be used as endowment for a distinguished service professorship. A grant of $8,000 also has been received from the Utilities Research Commission for research work under the direction of Professor Arthur H. Compton, of the department of physics, in the characteristics of electrical insulation. $25,000 has been received from the Milbank Fund of New York City, to carry on research in infantile paralysis under the direction of Drs. Edwin O. Jordan and Ludwig Hektoen. The International Students' Extension has provided the sum of $11,250 to promote welfare work among foreign students at the university during the year 1928–29. LaVerne Noyes scholarships to the amount of $12,000 have been provided for Rush Medical College for the year 1928–29 by the estate of LaVerne Noyes.

THE Astronomical Society of France has announced the foundation of a new prize of 5,000 francs by M. Raoul Bernard to be awarded for practical results attained in the investigation of the high regions of the atmosphere. 10,000 francs will be awarded to the person who attains the height of 100 kilometers within the period of five years.

ACCORDING to the Japanese correspondent of the *Journal* of the American Medical Association the Rockefeller Foundation has arranged for several Japanese professors of medicine to go to America to pursue investigations. It plans to establish an organization for public health in Japan, and it has arranged for the exchange of medical investigators between America and Japan. The committee for the exchange scholarship has decided to send this year

Dr. M. Nishio, professor in the Jikeikai Medical College, and Dr. T. Matsuzaki, professor in the Imperial Girls' Medical College.

IN connection with the second International Congress of Radiology meeting in Stockholm it was announced that the cancer fund, which was begun as a birthday tribute to King Gustav on his seventieth birthday, already amounts to $1,500,000. The fund will be applied to research on the treatment of cancer.

IT is announced that Mrs. Cora Liggett Fowler's will gave $1,500,000 to St. Luke's Hospital, St. Louis, for a clinic and research laboratory.

IN cooperation with the Mexican Department of Agriculture, the Bureau of Entomology of the United States Department of Agriculture is organizing a research laboratory in Mexico City to study the Mexican orange worm. Since Mexico City is at a rather high altitude, it was said, two sublaboratories are being established at Morelos and Cuerravaca, Mex. The laboratories are furnished with complete equipment to study all phases of the Mexican fruit worm, which has been doing damage in the Rio Grande Citrus Belt.

THE War Department has announced that the governor-general of the Philippine Islands, Henry L. Stimson, is planning a campaign to improve the health of the Filipinos, and that an appropriation has been approved for the establishment of a school of hygiene and public health at the University of the Philippines, Manila. The school will be established with a curriculum modeled on that of the best schools of the type in the United States to train the 400 officers of the Philippine Health Service and other physicians for the prevention of disease.

Nature states that on June 14 the Duke of Connaught opened the George Moore botanical laboratories at University College, Southampton. The new buildings have been made possible by a bequest under the will of the late Mr. George Moore, of Southampton, and have been designed by the staff of the college, and particularly Professor S. Mangham, professor of botany, and E. E. Mann, lecturer in civil and mechanical engineering. The dimensions of the building are 120 ft. x 30 ft., and it runs east and west, the north side being glazed so far as possible to afford facilities for microscope work. There are two floors. The ground floor provides thirteen rooms, including a theater, two lecture rooms, library, two laboratories for physiology and a photographic dark room. The upper floor has seven rooms, including a large elementary laboratory, pathological laboratory, laboratory for advanced work in systematic and structural botany and plant biochemistry, an exhibit room and the usual preparation rooms. Plant houses, partly glazed with "Vita glass," have been built along the south front and western end, and the surrounding grounds will be developed as a botanical garden. In drawing up the plans of the building, full provision has been made for increased accommodation for research work.

RUTGERS UNIVERSITY has announced the gift of a valuable and historic collection of herbs from Dr. H. H. Rusby, of the College of Pharmacy of Columbia University. The herbarium was gathered seventy years ago by Dr. P. D. Knieskern, a pioneer collector of native plants of New Jersey.

UNIVERSITY AND EDUCATIONAL NOTES

THE division of bacteriology of the University of California Medical School starts the fall courses in the new quarters in San Francisco, in one of the medical school buildings. The course has heretofore been given in Berkeley as one of the premedical courses, open to both the medical and academic students. The staff will consist of Dr. Karl F. Meyer, *chairman*, and Dr. M. S. Marshall, Dr. H. W. Estill, Miss Bernice Eddie and Miss Evelyn Lewis. The department of bacteriology in the college of letters and science will continue to give instruction at Berkeley. Dr. Meyer will remain chairman of the department and will be associated with Dr. T. D. Beckwith and Dr. A. J. Salle.

DR. JOHN J. TIGERT, commissioner of the U. S. Bureau of Education, has resigned to accept the presidency of the University of Florida.

RECENT promotions to full professorships at the University of Chicago include Dr. W. C. Allee and Dr. C. R. Moore in the department of zoology, Dr. W. J. G. Land in the department of botany, Dr. H. B. Lemon in the department of physics and F. E. Ross in the department of astronomy.

PROFESSOR HERBERT WOODROW, head of the department of psychology in the University of Oklahoma, has been appointed head of the department of psychology at the University of Illinois to succeed Dr. Madison Bentley.

DR. BENJAMIN GRAVE, professor of zoology at Wabash College, has been appointed director of the department of zoology at De Pauw University.

AT Columbia University, Associate Professor G. W. Mullins, of Barnard College, has been promoted to a full professorship of mathematics, and Dr. R. G.

Archibald and Dr. B. O. Koopman have been promoted to assistant professorships of mathematics.

DR. ALBERT E. BULSON, JR., has been appointed head of the department of ophthalmology of the Indiana University School of Medicine, Indianapolis.

DR. JOSIAH BRIDGE, associate professor of geology in the Missouri School of Mines, has been appointed as research professor at Princeton University.

ASSISTANT PROFESSOR J. D. TAMARKIN, of Brown University, has been promoted to a full professorship of mathematics.

DR. ADOLPH FRAENKEL, professor of mathematics at the University of Marburg, has been called to the University of Kiel.

AT the University of London, Dr. Robert Donaldson has been appointed to the Sir William Dunn chair of pathology, tenable at Guy's Hospital Medical School. Dr. S. J. Cowell has been appointed to the university chair of dietetics, tenable at St. Thomas's Hospital Medical School.

DISCUSSION AND CORRESPONDENCE

THE VIABILITY OF ALGAE

SPHAERELLA *Sommerfeldt* is a familiar and widely distributed alga. During moist periods the single-celled plants grow and multiply rapidly, being green and free-swimming. With the evaporation of the water, the motile cells come to rest, change to red and are provided with a thick wall. In this state they may be found closely adhering to the substrate, sometimes so abundantly as to give the appearance of red paint. Cemetery urns, house gutters and even discarded household pans are not unusual places where the plants may be found. In the dry condition, the alga may become detached and blown by the wind to other localities, sometimes distant, there to resume the motile green state with the coming of another supply of water. Presumably these plants are enabled to withstand considerable drying out and for considerable periods of time, but little reliable information bearing on the longevity or viability of the resting cells, especially under adverse or extreme conditions of environment, appears to be available. Undoubtedly the ability to withstand desiccation is one of the factors which has led to the wide distribution of algae such as the one mentioned.

It has been reported[1] that certain living algae have remained viable in samples of soil which had been stored in bottles for varying periods of years, in two cases for as long as seventy years. The samples were apparently partially air dried before being sealed, and at the time of opening the bottles the water-content of the soils was found to vary from 3 to 5 per cent. in some samples, to 10 per cent. in others. In no case, however, was it thought that there was present sufficient water for active vegetative growth during the time of storage. The present writer has followed the history of a collection of Sphaerella pluvialis *Flotow* through a period of nearly seven years; and while the maximum period of viability has not yet been ascertained, the results are sufficiently interesting to warrant recording at this time.

The sample of Sphaerella which has been under observation was collected by Dr. Francis H. Herrick on August 18, 1921, from a pocket of granite in Georgian Bay, Canada. The scrapings consist of a mixture of small twigs, a few partly decayed coniferous needles and some rock fragments. When received, the material was very dry, and in this condition was placed in a glass bottle, corked, and has since been stored for most of the time on a shelf in a moderately illuminated room. Except for opening the bottle occasionally to remove material for testing, the bottle has been kept corked, and no water has been allowed to reach the contents. The material has been tested for viability at least once a year by adding water to a bit of the dried scrapings.

At the start, the time required for the red resting cells to become green and motile did not exceed twenty-four to forty-eight hours. As time has passed, the time for motility to be attained has become appreciably longer, as would be expected. At this writing, a test has just been completed, using both tap and distilled water. Under the conditions of room temperature and moderate light intensity, the time required to "come to life" is now a matter of six to seven days. Once activity has been manifested, multiplication becomes rapid and the culture jar becomes a chamber swarming with active forms; and within a day or two longer the water has a distinctly greenish cast. The motile algae obtained in this way have been under observation for a number of weeks and have been subjected to various tests. So far as can be observed, in spite of nearly seven years of storage, during which time the alga has been without water, there has been no apparent deterioration of the cells, and they behave quite as do freshly collected ones.

The writer hopes to continue at intervals his tests for viability on this culture to ascertain how long the alga will remain viable. It is possible that other dated collections of algae, which normally undergo a resting period, have been or could be tested for viabil-

[1] Bristol, B. Muriel, "On the Retention of Vitality by Algae from Old Stored Soils," *New Phytol.*, 18: 92–107, 1919.

ity. The writer would be glad to receive small samples of such collections, together with the accompanying data on collecting and storage conditions, for the purpose of testing the viability. He would like also to receive any information bearing on the viability of such algae, if any one has made such tests.

CHAS. H. OTIS

UNIVERSITY OF WISCONSIN

WHAT IS THE FIRST FOSSIL COLLECTED BY MAN?

THE question has been frequently asked, "What is the first fossil collected or handed down by man?" Mr. Barnum Brown, in *Natural History* (Sept.–Oct., 1926) again raises the query. He presents curious evidence for the "claims" of discovery or collection of a tooth of *Elephas antiquus* by the ancients of two thousand years ago. The tooth was associated with sculptures and figures covered by débris in the ruins of the Asklepieion, the ancient medical school of Hippocrates, the father of medicine. There is no doubt of this collection and preservation by the Greeks, and it is obvious that the fossil tooth was brought in as an object of some kind of singular interest. Was it recognized as an elephant's tooth? Perhaps so; for the Greeks were of keen intellect, and may not have made the pious blunder of those north Europeans of but a few centuries ago, who flattered themselves by reinterring the bones of a mammoth as one of their giant ancestors. Even yet, in some of the mountainous districts of China considerable quantities of fossil bone are ground up for medicinal use!

Nevertheless, a far older instance of "collection" is that of the petrified plant type of the Capellini Museum of the University of Bologna, known as *Cycadeoidea Etrusca*. This fossil was certainly handled by the Etrusci as an unusual object over four thousand years ago. It was refound just fifty years ago on one of those striking stone tombs of the ancient Etruscan burial ground or necropolis at Marzabotto on the estate of the Count Aria, in the valley of the Reno amid the foothills of the Apennines, about eighteen miles west of Bologna. Evidently it was regarded by the Etrusci as some great curiosity or rarely marked block of black flint, to thus be given a place of honor and remembrance on one of their tombs. Further up the hillside there is seen the base of a small temple of a stately simplicity, and of the same period as the necropolis, though discovered somewhat earlier. And as a further confirmation of such an antiquity there is noted on one side of the fossil an elliptical polished out depression about the size of a woman's hand, very possibly of even a neolithic date. Here is a memento of a civilization as old as that which "chiseled out its code on the black diorite of Hammurabi."

The specimen itself is a segment of a medium-sized cycadeoid stem of the columnar type, just nearing the close of its flowering season. There is a faithful *papier maché* reproduction at Yale University, as well as thin sections cut from the original. This historic fossil is structurally important and was one of the first of its group to yield evidence for a flower-bearing, instead of the cone-bearing habit so long supposed to characterize ancient and modern cycads alike. Indeed, it was one of the flowers cut from this very stem that yielded to Capellini and Solms the first pollen grains ever seen in the cycadeoids.

LOUISE SUDBURY

NEW HAVEN, CONN.

QUERY ON "A REVISION OF THE FUNDAMENTAL LAW OF HABIT FORMATION"

WHILE reading a paper with the above title by Dr. Dunlap[1] the writer of this note wondered if psychological research had ever availed itself of the abundant data which might be obtained from music-teachers. The most successful of modern piano-playing methods —Leschitizky's—is based on the principle that the pupil should *never be allowed to make a mistake.* Pieces taken the first time are played very slowly and with the utmost concentration upon absolute accuracy. "Make no mistakes," said the writer's teacher, at the *Thomasschule,* "but if you do, get up, walk three times around the room, say the *Vater Unser,* and kick yourself! Then go back to the piano and play the passage correctly twenty-five times!" Rapid practice is absolutely forbidden until the piece is thoroughly mastered. Experience seems to show that if the student never makes a mistake in any given piece, he will never be able to do so, even when performing under unusual pressure. There are at present hundreds of pianists in the world who can reproduce hundreds of difficult, complicated pieces with a note-accuracy of at least 99.99 per cent.—repertoires which involve anywhere from a quarter of a million to a million individual notes. On the other hand, experience seems to show that if a piece is practiced carelessly at first no amount of subsequent diligence will ever bring it into a state of reliable performance. Long after all errors have been eradicated in private practice they will come out again if the piece is played in public or under unusual pressure.

The idea, based upon Dr. Dunlap's paper, that one could correct errors and learn to play a piece right by practicing it wrong is so revolutionary and would, if applicable, save piano-students such a vast amount of weary practice that the writer devised a test ex-

[1] By Dr. K. Dunlap, SCIENCE, Vol. LXVII, No. 1736.

periment on himself. In early youth he had often attempted pieces beyond his capacity and worked errors into his performances which later proved difficult to eradicate. One of these pieces—the Bach-Tausig "Toccata and Fugue in D minor"—was chosen for the experiment. A passage was selected which contained five "perilous points," *i.e.*, chords in each one of which a certain error was likely to occur. The writer practiced this passage, slowly and carefully, ten times daily, purposely putting in the wrong notes, for two weeks, trying meanwhile to impress himself mentally that this performance was wrong and should not be allowed in a regular rendition. On the fifteenth day the whole piece was attempted at a suitable tempo and—presto!—gotten over without an error. After several more perfect performances at intervals of a day or two the writer had the hardihood to attempt a final test by demonstrating the "perilous passage" to an advanced pupil. The result was disastrous and humiliating; every one of the carefully practiced mistakes turned up again!

Perhaps piano-playing is not exactly analogous to typewriting. Perhaps the conditions of this experiment were not correctly arranged. It may be that the laws governing ordinary habit-forming do not hold in performances which approach the upper limit of mental and manipulative dexterity. But if there is any way in which the idea of Dr. Dunlap's paper could be applied to instrumental practice the whole musical world would look up to him as a benefactor.

G. WAKEHAM

UNIVERSITY OF COLORADO,
COLLEGE OF MUSIC

GEOMETRICAL CONSTRUCTIONS ON THE SPHERE

THE Willson hemisphere is well adapted for the use of the individual student desiring to make constructions on the sphere. For demonstrating such constructions to a class it is, however, inconveniently small. To overcome this difficulty an opal glass light shade of spherical shape and about fourteen inches in diameter may be used. Such shades are commonly employed, one at the top of each lamp post, in parks and campuses. Lines may be readily drawn on them by using the type of pencil made especially for marking on glass. In addition to the advantage of large size, these globes represent considerably more than half of the sphere. If one desires to draw a great circle, a stretched string is a convenience, one end of the string being secured to a small rubber vacuum cup which will adhere to the spherical surface.

H. R. GRUMMANN

DEPARTMENT OF MATHEMATICS,
WASHINGTON UNIVERSITY

SCIENTIFIC BOOKS

The Soils of Cuba. By HUGH H. BENNETT, soil scientist, Bureau of Soils, U. S. Department of Agriculture, and ROBERT V. ALLISON, formerly chemist and soil biologist, Tropical Plant Research Foundation. 101 illustrations. Pp. xxiv + 410. 4 maps, including large soil map of Cuba in folio with key to the principal soils of Cuba. Price, $6.25. Published by the Tropical Plant Research Foundation, Washington, D. C.

THIS book is a record of the most comprehensive study of the soils of a large tropical area that has been undertaken since the development of the more modern ideas on the investigation and classification of soils. After the introduction stating the reasons for carrying on the survey, the general characteristics of the soils are discussed, contrasts between most of the soils of this region and those of temperate climates being brought out. The basis for classifying the soils into families, series and types is considered. This is followed by descriptions of the soil series, the different related series being grouped into families.

The majority of the series, of which there are over ninety, are named for Cuban localities near which the soils were first studied and identified. Certain of the soils of western Cuba, however, are identical with and are described under the names of series occurring in the southeastern United States. Discussions and tables giving the results of chemical and physical studies of many of the soils are included. These include complete chemical analyses, studies of soil concretions (perdigon), H-ion concentration, base exchange values, mineralogical analyses and quantitative measurements of physical properties.

Following this are chapters on middle, eastern and western Cuba and the Isle of Pines. Each of the three Cuban areas is divided into a number of soil regions which are discussed separately. The profile characteristics of the important soil types of each region are described and the agricultural use of each discussed.

There is a short chapter on salt in Cuban soils and its relation to crop production. Another chapter deals with soil moisture studies. It appears that certain of the heavy clay soils through improper and infrequent cultivation have become so compact that they will hold very little water above the wilting point. There is also a chapter on the climate.

The final chapter dealing specifically with Cuban soils is given over to a discussion of the relation of soils to agriculture in Cuba. The importance of the soil type in agricultural studies is emphasized. The fact that different soil types respond to widely dif-

ferent cultural practices is brought out. It appears that this has not been considered by many of the cane growers who frequently fail to make profits because of this. The relation of soil types to each important crop of the country is discussed, special emphasis being placed on sugar cane, which is by far the most important crop of the island.

Dr. Curtis F. Marbut, of the Bureau of Chemistry and Soils, has contributed an interesting chapter on soil classification. This is followed by an appendix, tables, a glossary, a list of plant names, a rainfall map, a detailed soil map showing soil types and content of water soluble salts of an area on the south coast of Havana Province and an index. The illustrations are varied and well selected.

This volume is interesting throughout and should form a basis for future more detailed soil surveys in tropical areas.

WM. BATTLE COBB
NORTH CAROLINA STATE COLLEGE

SCIENTIFIC APPARATUS AND LABORATORY METHODS

EXTRACTS OF FRUIT SKINS AS SELECTIVE NUCLEAR STAINS

THE skin of the blue grape—Concord or Worden—contains a pigment that stains nuclear chromatin very selectively. Five grams of the powdered dried skins, placed in ten cubic centimeters of water, heated to the boiling point and filtered, gives a dark purple solution. This stains the nuclei of tissues, celloidin or paraffin sections fixed in formalin or Zenker's fluid, or frozen sections either fixed in formalin or unfixed, a purplish color which becomes blue when the section is washed in tap water five minutes or longer. Eosin counterstaining can be used without altering the nuclear stain.

If one drop of a ten per cent. aqueous solution of ferric chloride is added to this aqueous solution of grape skins, the solution becomes blue and the sections are stained by it more deeply but must be decolorized with one per cent. hydrochloric acid alcohol (70 per cent.). If the sections are then washed with tap water the nuclei appear blue, resembling sections stained with methylene blue. However, the staining is sufficiently strong and selective with the simple aqueous extract followed by washing with tap water, so that the use of ferric chloride or other oxidizing or mordanting agents is not necessary or recommended.

The stain is taken up by the chromatin very selectively, and the differentiation is excellent. There is no tendency to overstain. The nuclei of rapidly growing cells, as in carcinoma, stain deeply, and mitotic figures are intensely blue. The stain is as effective when made from the fresh fruit skins, and a section of kidney stained in this way and exposed to diffuse light is now as blue as when prepared eight months ago. Even daily exposure to direct light in a south window for five months did not lead to any appreciable fading of the sections so stained. Evidently then this dye is of satisfactory permanence.

Blackberries, black raspberries, blueberries, huckleberries, the skins of black figs, large purple plums, small purple plums, dark red plums and blue plums, and black sweet cherries, have all been found to contain pigment which may be extracted in usable condition by merely boiling with water. The coloring matter thus obtained has a marked and selective affinity for the chromatin of tissue cell nuclei. If the fruit skins contain much acid, as in the case of the plums, the staining is red, but when washed in tap water the nuclei become blue, and unless the section has been stained for a long time, ten or twelve hours, for instance, only the nuclei retain the stain. The juice expressed from the black raspberries and blackberries before heating also stains nuclear chromatin readily. Blueberries have a tougher skin and have to be boiled to obtain results that are satisfactory, and the extract thus secured is apparently the most active of any of these fruits.

For large-scale production, grape skins offer an economical source. Grape juice, as on the market for beverage purposes, does not contain enough of the coloring matter to be used for staining. An extract made by boiling ten grams of the dried grape skins for one hour in one hundred cubic centimeters of 50 per cent. alcohol was very satisfactory. It stained no better than an aqueous extract of the same strength, but it has keeping properties that make it preferable.

Such a simple, inexpensive and universally available staining material would seem to have possibilities. It demands no complex method of preparation and mordanting. No aging is required, as with hematoxylin, and the stain can be used at once. It seems to be fully as selective as hematoxylin, is much less expensive and apparently is very permanent as far as yet determined.

MERCY A. SOUTHWICK
DEPARTMENT OF PATHOLOGY,
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A MICRO-GUILLOTINE

THE instrument described here was designed primarily to effect at any desired place and with a high degree of precision the breaking of the tip of a micropipette made by the method described at various times by Chambers.[1] It has been found in practice that

[1] Chambers, Robert, *Anat. Rec.*, Vol. 24, No. 1, 1922.

the method of breaking by bringing the tip up against the coverslide (Chambers)[1] frequently results in faulty micro-pipettes, thus causing a considerable loss of time.

The device consists of a frame made of a strip of brass with a thin groove milled out along its center and folded to form a square with the groove inside.

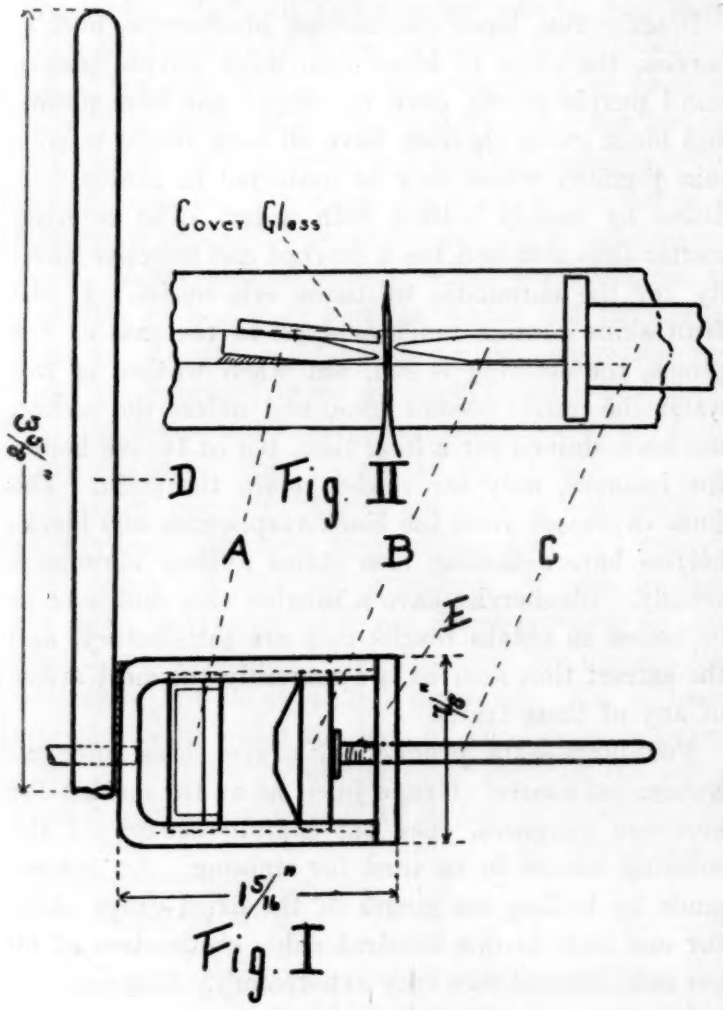

Fig. II

Fig. I

Into this groove are fitted (A) a piece of Gillette safety razor blade and (B) another piece of blade, cut to form a rough wedge front and attached to a holder (C) (in this case an ordinary wire nail) by which it may be drawn back and forth. On top of blade A is a thin piece of cover-glass so placed as to leave a space between it and the blade, just wide enough for the edge of blade B to enter (see Fig. 2). The edges of this cover-glass and blade A which face blade B must be accurately lined up, one above the other. The entire frame is soldered to a rod as indicated.

In operating, the guillotine is supported by the rod in one of the holders of the micrurgical machine under the microscope and the pipette introduced between the blades. The guillotine and the pipette are then approximated to each other until the pipette rests against blade A at the place where the break is to be made. Blade B is then pushed in gently, but firmly against the pipette and the break is made (*cf.* Fig. 2). The blades must be scrupulously clean or the pipette may clog. If greater delicacy in manipulating blade B is desired, the sliding holder to which it is attached may be changed for a screw and a hole may be tapped in cross-bar E to receive it.

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SPECIAL ARTICLES

RESULTS SECURED BY APPLYING THE FEULGEN REACTION TO FIBROBLASTS AND SARCOMATOUS CELLS IN TISSUE CULTURES

WHEN a cell once becomes cancerous the change in it is inherited and transmitted to all its descendants within the afflicted person. This persistence of malignancy has led investigators to suspect that the nucleus is profoundly modified; but no constant microscopically visible deviation from the normal has yet been demonstrated. With the idea of again attacking this problem Dr. Alexis Carrel very kindly gave me a series of tissue cultures of normal fibroblasts and of sarcomata and to them I have applied the reaction recently introduced by Feulgen[1] for the demonstration of thymonucleic acid in the hope that thereby some slight difference associated with malignancy might be brought to light.

The reaction depends upon the formation of a relatively insoluble dark purple compound in regions of the nucleus containing thymonucleic acid. The distribution of the reacting material is very restricted. It does not occur, for example, in either the Nissl bodies of nerve cells or the chromidial substance of gland cells, although both of these materials stain like nuclear chromatin with basic dyes, and like it also contain detectable amounts of masked iron. The exact technique employed is described elsewhere.[2]

Special precautions were observed in order to make the comparison between the normal and malignant cells as close as possible. In the cultures the normal fibroblasts and sarcomatous cells were planted side by side in the same flasks. After their rate of growth had been determined they were fixed simultaneously by flooding the flask with a mixture consisting of equal parts of absolute alcohol and saturated aqueous corrosive sublimate. The layer of coagulated plasma covering the bottom of the flask and containing both groups of cells was then removed and its edges cut

[1] Krause, R., *Enzyk. f. mikr. tech.*, 1927, Vol. 3, pp. 1729–1732.

[2] Cowdry, E. V., SCIENCE, 1928.

so that a longer stretch of the layer of plasma remained in continuity with the fibroblasts than on the other side of the adjacent sarcomatous cells. This was done for purposes of identification. After dehydration and embedding, the block was oriented in such a way that corresponding serial sections of fibroblasts and sarcomatous cells were cut simultaneously. Since they were mounted in parallel rows (attached together by the coagulated plasma) on the same slides, both were subjected to exactly the same microchemical treatment. The experiments were all made at the Rockefeller Institute for Medical Research in New York.

In Experiments 1 and 2 normal rat fibroblasts and the cells of rat sarcoma X (from the Crocker Foundation) were cultivated close together in the same flasks. In both experiments the sarcomatous nuclei gave a much stronger Feulgen reaction than did those of the fibroblasts. But it was thought that the difference in the nuclei might be in a sense accidental or that the reaction given by the nuclei of fibroblasts might normally be somewhat inconstant and subject to variation, in which event no significance could be attached to the difference observed.

Accordingly, Experiment 3 was planned to determine the influence upon the reaction, if any, of differences in nutrition. Cultures of Carrel's old strain of chicken fibroblasts were made in two flasks in tyrode and embryonic extract, respectively. Simultaneous fixation was secured by immersing both flasks in a beaker containing a generous supply of the alcoholic sublimate mixture, after which the groups of cells were removed and carried through all steps in the technique together. Examination showed that the reaction of the nuclei was apparently identical in both, being faint like that of the rat fibroblasts, and this despite the fact that the cells cultured in tyrode had been starved as compared with the others living in embryonic extract.

Experiment 4 was then made as a check on Experiments 1 and 2. The technique was the same except that as a further control the normal fibroblasts were planted between two fragments of sarcoma. Again the results were equally striking. As one passed from the first sarcoma to the normal the purple color of the nuclei faded abruptly only to suddenly increase again on reaching the second piece of sarcoma.

The object of Experiments 5 and 6 was to determine whether the nuclei of another sarcoma exhibited an equally strong Feulgen reaction. Cultures were accordingly made in duplicate in diluted liver digest of rat sarcoma X and of the Jensen rat sarcoma placed side by side. With both tumors the reaction was found to be intense and indistinguishable in degree. Evidently, therefore, the intense reaction is just as characteristic of the two sarcomata as the feeble reaction is of the fibroblasts of the rat and of the chick in the cultures investigated.

In order again to test the difference noted in Experiments 1, 2 and 4 between the reaction of the nuclei of normal rat fibroblasts and those of rat sarcomata four more experiments were performed. In the first two (Nos. 7 and 8) normal rat fibroblasts and rat sarcoma X were studied as cultivated in diluted liver digest. In both of them the sarcomatous cells gave regularly and constantly a more intense Feulgen reaction than the normal fibroblasts. In the second two (Nos. 9 and 10) a comparison of normal rat fibroblasts and the Jensen rat sarcoma cells was made under similar conditions and gave the same results.

The conclusion then seemed inevitable that, under the conditions named (and this is a necessary qualification), the nuclei of both tumors are much richer in the substance giving the Feulgen reaction, which is probably thymonucleic acid, than the normal rat fibroblasts. This result was rather unexpected because no such distinction was observed by either Roskin[3] or Ludford[4] both of whom studied fragments of excised tumors by Feulgen's method.

To discover whether the same difference also holds in neoplastic cells *in vivo*, as was found in the tissue cultures, Dr. J. B. Murphy very kindly gave me a number of mice with tumors for examination. These included one sarcoma (180), several spontaneous mammary cancers and a transplanted mammary cancer (Bashford, 63). With each a variety of other tissues were fixed in the same fluid and sections were mounted on the same slide so that the microchemical reaction was applied alike to the tumors and normal tissues.

It was found that the thymus gland always gave a more pronounced Feulgen reaction than the tumors, but this was expected because the thymus is known to contain unusually large amounts of thymonucleic acid. In the other fragments of tissue the nuclei of the tumor cells were strongly stained so that the extent of the neoplasms could be readily seen by naked-eye inspection of the slides. Although this was the case in a gross way, when it came to a direct microscopic comparison between the nuclei of individual sarcomatous cells and those of unaffected fibroblasts no noticeable difference could be made out; yet it is possible that the introduction of accurate methods of estimating the color values might reveal a slight divergence between them. Just how the nuclei of the

[3] Roskin, G., *Zeit. f. Krebsforsch.*, 1925, Vol. 22, pp. 472–479.

[4] Ludford, R. J., *Proc. Roy. Soc.*, Series B, 1928, Vol. 102, pp. 397–405.

mammary cancer compare with those of normal mammary glands remains to be determined.

It is unsafe at present to try to explain why such an outspoken difference was noted between the nuclei of sarcomatous cells and those of normal fibroblasts in the tissue cultures examined, while a similar difference could not be detected in pieces of excised tumors. The results are merely reported as they stand for the present without interpretation.

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THE PLEISTOCENE ELEPHANTS OF SANTA ROSA ISLAND, CALIFORNIA[1]

W. G. BLUNT's discovery of fossil teeth of an elephant on Santa Rosa Island, one of the Channel Islands off the coast of southern California, was recorded by Stearns[2] in 1873. Since that time this interesting and significant occurrence has been referred to by several authors. Hay[3] has recently summarized the available information and recognizes the presence of *Elephas imperator* and of an undetermined species.

During the past year Dr. Spencer Atkinson and Mr. J. A. Barbieri, of Pasadena, secured a fragmentary elephant skull on Santa Rosa Island and presented the specimen to the California Institute of Technology. Through the courtesy of the Vail Company of Los Angeles, owners of the island, the California Institute, with the cooperation of the Carnegie Institution of Washington, have been given the opportunity to investigate the occurrence, and facilities were kindly made available to collect further remains.

Santa Rosa Island is the second largest of four islands separated from the mainland by the Santa Barbara Channel, which has an average width of twenty miles and an average depth of approximately six hundred feet. The geology of this insular area has been recently studied by Kew.[4] The Pleistocene deposits in which the elephant remains were found occur in the northwestern portion of the island, where they are well exposed in the sea-cliffs and are eroded into bad lands along the stream courses or canadas. These deposits are largely of terrestrial origin and consist of clays, sands and gravels, reaching a thickness in places of more than seventy-five feet. At one locality a whale vertebra was found at the base of the Pleistocene strata. The beds rest with marked unconformity upon northward-dipping, marine Miocene sandstones and shales and have suffered little or no deformation. Since their accumulation, however, the Pleistocene beds have been subjected to subsidence, planation and uplift, for at least one well-defined terrace cut into the deposits is now situated at an elevation of seventy-five feet above sea-level. On this terraced surface occur sand dunes and shell mounds in which Indian burial sites are frequently encountered.

The collections secured by the California Institute include a number of teeth, parts of skulls and skeletal material. Occasionally several skeletal elements and teeth are found associated in the deposits. Usually the remains are scattered. One curious feature of the occurrence is the apparent total absence of associated mammalian types. The proboscidean remains are referable to the genus *Elephas*. The individuals exhibit considerable variation in size, and this is undoubtedly to be ascribed in part to differences in age. A survey of the collection as a whole yields the impression rather strongly that the elephant types were of relatively small size. Some of the forms may have a height of six to eight feet as measured at the shoulder. The larger individuals are perhaps comparable in size to the American mastodon and are certainly smaller, possibly considerably smaller, than the Pleistocene mammoths of the southwestern United States.

While the Santa Rosa Island elephant has been determined as representing the species *Elephas primigenius* Blumenbach and *E.* (*Archidiskodon*) *imperator* Leidy, the difference in size, coupled with differences noted in the skull and dentition, seem quite clearly to distinguish the island form as a distinct species for which the name *Elephas exilis* is here proposed. The type of the species is No. 14 Calif. Inst. Tech. Coll. Vert. Pale., a skull and mandible including four cheek-teeth and two tusks. A fuller description of the species will be published elsewhere.

The relatively small size of the Pleistocene elephants of this region suggests the interesting possibility of a dwarfing of these forms induced by insular isolation. This brings to mind the occurrence of the pigmy elephant *Elephas melitensis* Falconer in the bone caverns of Malta and of the related *E. mnaidriensis* Adams of Sicily, types which have become classic in paleontological literature as examples of a dwarfing of large mammals resulting from island isolation. While the factor of isolation may have been influential in producing the characters exhibited by the Santa Rosa Island elephant, it should be clearly recognized

[1] Paper read in part at the meeting of the Cordilleran section, Geological Society of America, Berkeley, California, March 3, 1928.

[2] Stearns, R. E. C., Proc. Calif. Acad. Sci., Vol. 5, p. 152, 1873.

[3] Hay, O. P., Carnegie Inst. Wash. Pub. 322B, pp. 42, 43 and 51, 1927.

[4] Kew, W. S. W., Bull. Geol. Soc. Amer., Vol. 38, pp. 645–654, 1927.

that no definite evidence is at hand to indicate that the forms were not small when, during Pleistocene time, the distribution of these types extended westward into the region now occupied by the Channel Islands, unless that evidence rests on the failure to identify similar forms in Pleistocene deposits on the mainland.

The presence of Pleistocene elephants on Santa Rosa Island furnishes apparently a striking confirmation of the view that profound changes in the coast line of southern California have occurred in late geological time.

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A COLLECTION OF ANAEROBIC BACTERIA

DURING the past sixteen years I have devoted much time to collecting, identifying and studying anaerobic bacteria. My interest in these micro-organisms grew out of the fact that all the bacteriologists whom I knew in 1912 threw up their hands when anaerobic bacteria were mentioned; not one understood how to isolate an obligate anaerobe from a mixed culture with any degree of precision or how to identify one afterward. In the same year I was fortunate enough to be assigned the task of developing a tetanus antitoxin laboratory for the Cutter Biological Laboratory in Berkeley, California. Tetanus antitoxin had never been made anywhere in the western United States previously, and this laboratory was the first to undertake it. During the following year, about the time we had successfully completed the immunization of our first horses, I met Dr. K. F. Meyer, who had just been appointed associate professor of bacteriology in the University of California. Dr. Meyer was the first bacteriologist of my acquaintance who seemed to know anything about the obligate anaerobes, and while I have never been directly associated with him in his laboratory, notwithstanding he was both my predecessor and successor at Berkeley, I am glad to acknowledge his valuable guidance on numerous occasions.

The early phase of my studies involved securing so-called "type cultures" from as many sources as possible, and the development of my own technic in checking the purity and identity of these. A few of these cultures were pure and correctly named, but some of them were impure and many were misnamed. It was not until Weinberg and Seguin's memorable monograph "La Gangrene Gazeuse" (1917) became available in 1920 that we were able to recognize with any degree of certainty any but a few of the commonest species in the collection, which then numbered sixty-three strains.

I have continued to add new strains to the collection, partly by accretion from other laboratories, but mainly by isolation from original materials, soil, water, milk, accidental contaminations of culture media, spontaneous infections in laboratory animals, and particularly during the past five years from human sources, both ante- and post-mortem.

The collection now contains 319 strains, 282 of which have been at least tentatively purified and identified, while thirty-seven other non-pathogenic strains have been presumably purified but not identified. Some of the latter possibly represent new species, others are probably species whose descriptions are buried in obscure or unavailable scientific articles. These obviously offer excellent material for further taxonomic research in this group.

Among those that have been identified are the following species, those that are definitely pathogenic being starred thus *. In a few instances the identification is only tentative.

B. bifermentans	6	strains
*B. botulinus, Type A	4	"
*B. botulinus, Type B	4	"
B. butylicus, B. amylobacter, B. butyricus and related species	9	"
B. centrosporogenes	28	"
*B. chauvoei	4	"
B. fallax	1	"
B. flabelliferum	4	"
*B. hemolyticus	1	"
*B. histolyticus	13	"
B. multifermentans	9	"
B. non-fermentans	2	"
*B. Novyi	8	"
*B. oedematoides	3	"
B. putrefaciens	4	"
B. putrificus (and B. cochlearius?)	8	"
*B. septicus	14	"
*B. Sordellii	3	"
B. sporogenes	32	"
B. sphenoides	1	"
B. sub-terminalis	1	"
B. tertius	15	"
*B. tetani	24	"
B. tetanomorphus	3	"
B. tyrosinogenes	1	"
*B. Welchii	40	"
Fusiformis (Sp.?)	3	"
M. gazogenes	37	"
Total identified strains	282	

The number of strains of each species in the collection gives a clue, in a sense, to the frequency with which one who collects anaerobes in much the same spirit as an amateur entomologist collects butterflies

is apt to encounter them. Much depends, however, on the type of material being studied. When we first began collecting laboratory strains in 1913 many of them proved to be or to contain B. sporogenes, irrespective of label; now it is rare to receive a contaminated or misnamed culture from another laboratory. B. sporogenes occurs also not infrequently in soil, water and feces, but one almost never isolates it from autopsy material, except in case of a perforated intestine, and even then only rarely. Certainly the most common anaerobe recovered by us in human autopsies is B. Welchii, being often no doubt an agonal or post-mortem invader of the blood stream and tissues. B. centrosporogenes is one of the most ubiquitous and is likely to turn up in all kinds of material, both animate and inanimate. B. tertius and B. histolyticus are also fairly common in materials exposed to fecal or soil contamination. M. gazogenes is common in the mouth but has also been recovered elsewhere in the body.

The stock cultures are kept in brain medium[1] which not only serves as the medium of choice for culture of the largest number of species of anaerobes, but also excels most other media from the standpoint of viability. Most of the sporulating forms retain their viability for years sealed in brain medium, the non-sporulating forms for several months. The cultures are kept in duplicate, one tube being sealed, the other capped with "Capes-Viscose," the cotton plug having been removed in both cases. Capes Viscose does not form a perfect seal against evaporation, but it is better than rubber, which deteriorates very rapidly and permits easy access to a culture for several months. When the tube is opened, by cutting off the cap, a sterile cotton plug is inserted temporarily until the culture is capped again.

Many of the above strains have, of course, been referred to in considerable detail in various publications;[2] others have not been described at all, but they offer valuable problems for research in morphology, physiology and pathogenicity. There are also interesting problems in taxonomy and nomenclature to be solved, as, for example, the possible identity of some strains designated by separate specific names, or the separation of certain strains now designated by a single name into two or more species. The questions of serologic relationships, of synergic and symbiodic action and further commercial exploitation are all worthy of more study.

It has long been the writer's custom to distribute pure, identified strains of these and other microorganisms free of charge on request from other laboratories interested in them for purposes of teaching or research. The burden of demands upon the collection has now become so great, however, that it will be necessary hereafter to make a nominal charge, similar to that imposed by the American Type Culture Collection, of which many of my strains form a part.

It is natural, perhaps, for one to feel that his hobby constitutes a neglected field in education. Yet it is still true, as it was fifteen years ago, though of course to a lesser degree, that most bacteriologists are primarily aerobic bacteriologists (we anaerobic bacteriologists only have to come up for air occasionally). Most of them are still unable to deal scientifically with any but the commonest forms in pure culture. Knowledge of satisfactory means of isolation is limited to a few, and none knows better than the writer how often the most acceptable methods fall short for particular organisms in certain mixtures; our culture media are so highly selective.

Most courses in general and medical bacteriology slight the anaerobes because the technic is naturally more difficult than that for aerobes. Courses in anaerobic bacteriology should therefore require the former as prerequisites. Such a special course was given at Dijon during the war for army technicians. The writer also gave a course in anaerobic bacteriology for several years at the University of California in Berkeley, but this, I understand, was discontinued in 1925. It is now planned to resume the course at the University of Colorado School of Medicine in Denver, during the summer session beginning June 16, 1928. There will also be facilities for a limited number of graduate students.

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